

# Use of Home Monitoring Technology

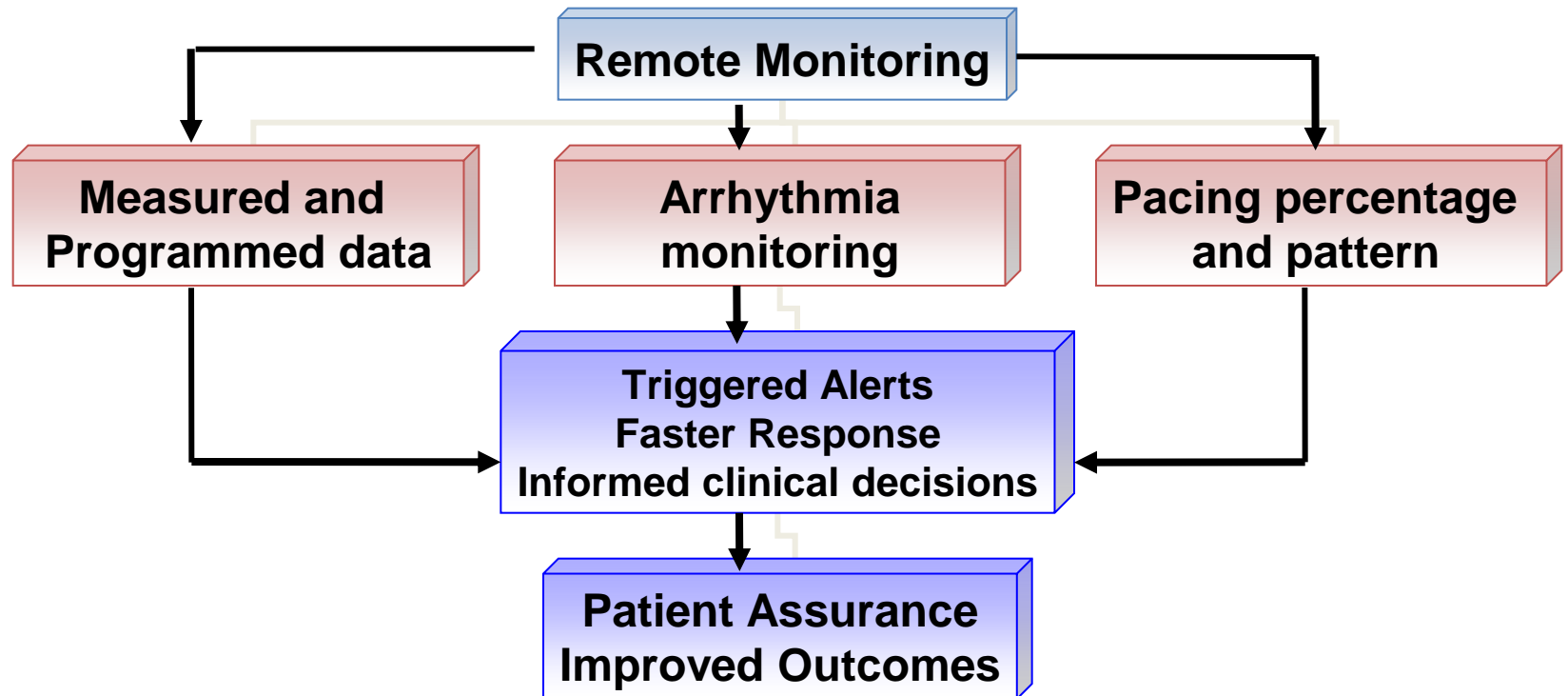
## **Case Studies**

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# Home Monitoring

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# Remote Follow-up

## HRS/EHRA Recommendations

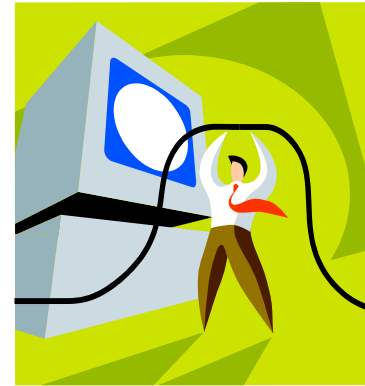
### In Person

- Post Implant
- Annually



### Remote

- Maintenance follow-up
- No programming required



# Factors Determining Type of Follow-Up

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- **Patient Related**

- Arrhythmia surveillance
- Cardiovascular symptoms
- Change in CVS medications (AADs)
- Geographical
- Pacing parameters
- Medical /social factors

- **Device Related**

- Measured parameters
- Therapies, pacing frequency
- Battery depletion

# Case 1

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- 18 yo female first year University student
- DR pacemaker implanted Jan 2011 .
- Sinus bradycardia, Mobitz type I and II heart block associated with congenital long QT syndrome type 1.
- An uncle died from SADS aged 20.

# Case I - Issues

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- Living alone at university
- Busy student life.
- Compliance with beta-blocker for LQTS?
- Parental anxiety regarding surveillance for arrhythmia while away from home.
- Unfamiliar local hospital and pacemaker clinic.
- Annual follow up by inherited cardiac conditions clinic at her 'home' hospital.

# Case 1 Outcomes

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## Biotronik Home Monitoring

- Continuity of care while at University.
- Reassurance for family and patient.

# Case 2

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- 89 yo female, frail, thin.
- Lives in a residential home.
- VVI pacemaker for permanent atrial fibrillation with slow ventricular rate in 2008.
- COPD, chronic oral steroids over many years.

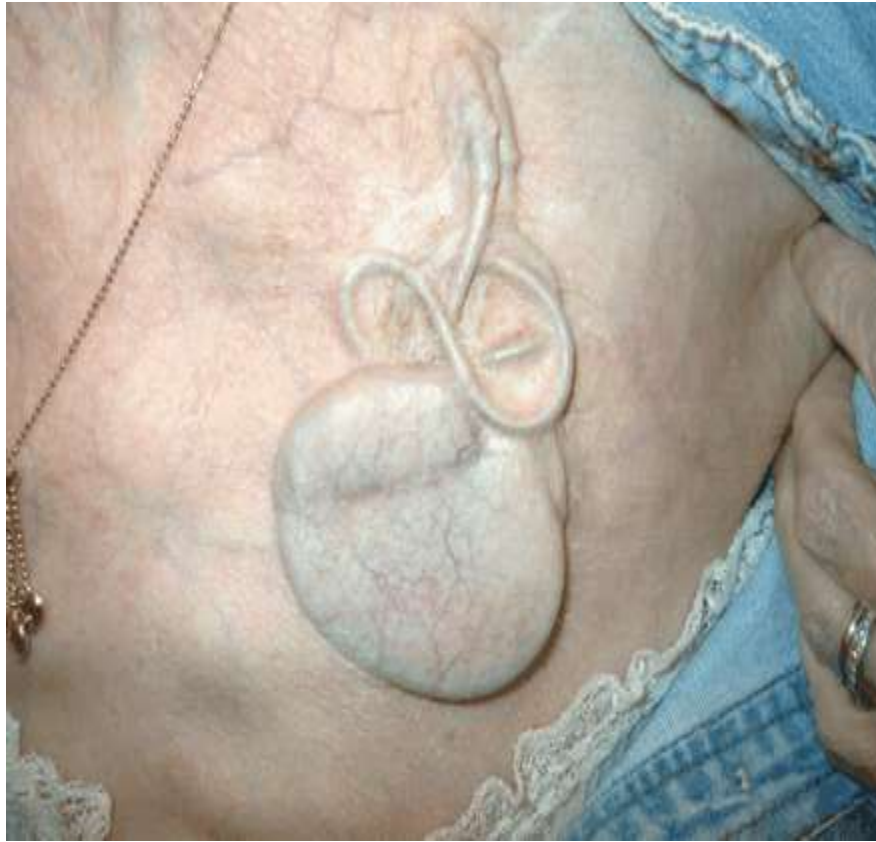
# Case 2 issues

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- Early dementia
- Residential home is 50 miles from pacemaker clinic.
- Transport difficulties.
- For home monitoring?

# Case 2

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# Case 3

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- 63yo female
- Presenting with symptoms secondary to SAN disease, and AVN disease.
- Hypertension, well controlled.
- AF 2 years ago, successfully cardioverted.
- Patient currently not on anticoagulation.

# Case 3 - Issues

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- Asymptomatic silent arrhythmia?
- Burden of atrial fibrillation?
- Thrombo-embolic risk?

Monitoring

Patients for review

All patients

New patient

Administration

Users

New user

Patient groups

New patient group

Transmitters

Option templates

Clinic settings

Site tools

Home

What's new

User profile

Contact

Imprint



Back to overview Patient 11 / 12 (filtered)

 Status on 26-Sep-2011 10:47 Evia DR-T / SN: 66019725  
Implantation: 19-Aug-2010

 Status Device settings Recordings History Patient profile Options  Save/print (PDF)

Summary Device Lead Bradycardia/CRT Atr. arrhythmia Ven. arrhythmia Physiologic. param. HF monitor

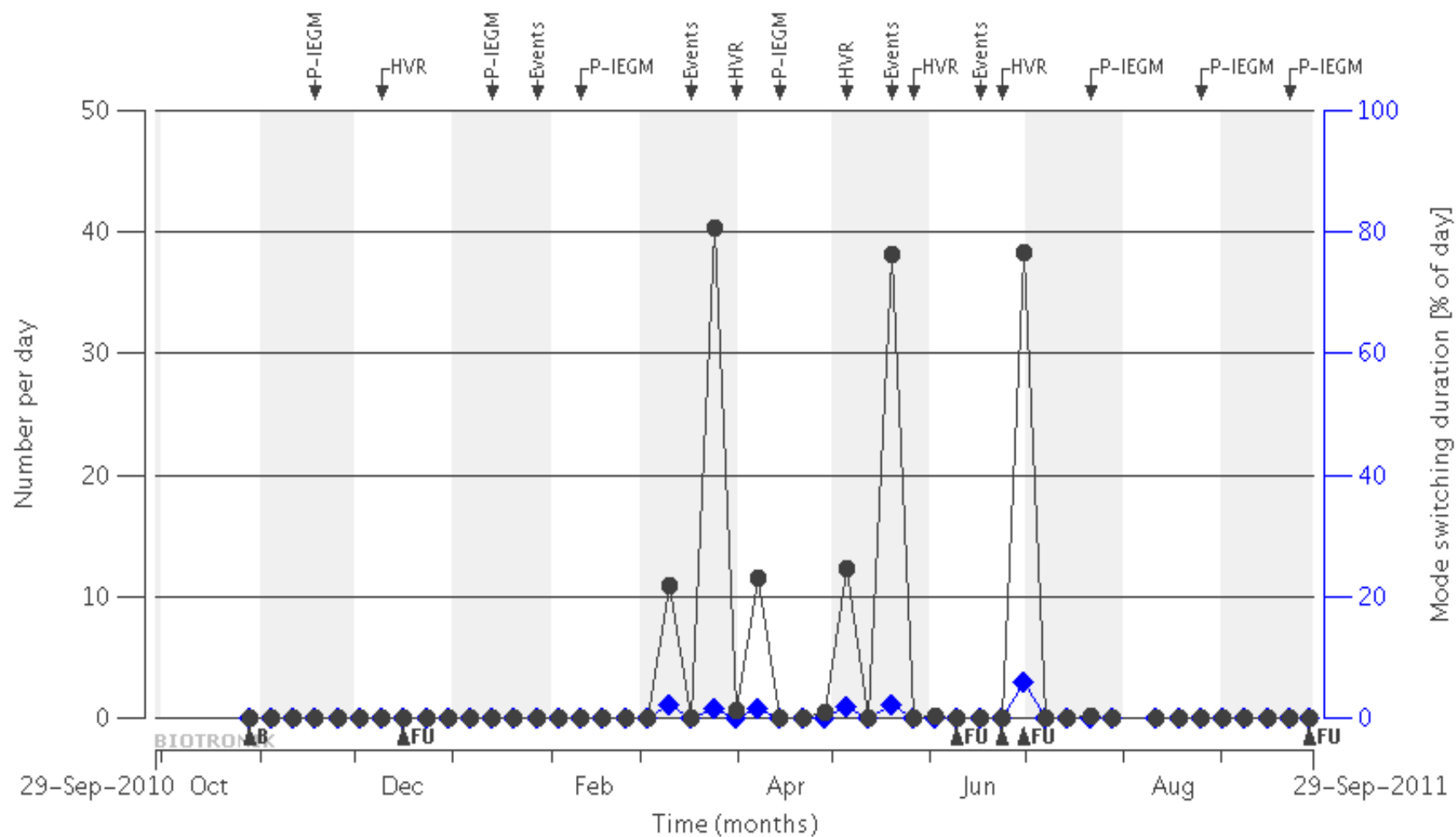
Last device message created on 21-Sep-2011 01:45:00

Atrial burden		24 h	Since 30-Jun-2011 01:45:00 Mean values
Atrial burden [% of day]		0	1
Atrial arrhythmia episodes per day		0	0
New long atrial episode detected (ongoing at end of mon. interv.)			NO
Start of ongoing atrial episode			---
Mode switching			
Number of mode switching per day		0	4
Duration of mode switching [% of day]		0	1
Mean ventricular rate during mode switching [ppm]		---	93
New long mode switching episode detected (ongoing at end of mon. interv.)			---
Start of ongoing mode switching episode			---

# Mode switching

Figure shows mean values per week

● Number of mode switching per day ◆ Duration of mode switching [% of day]

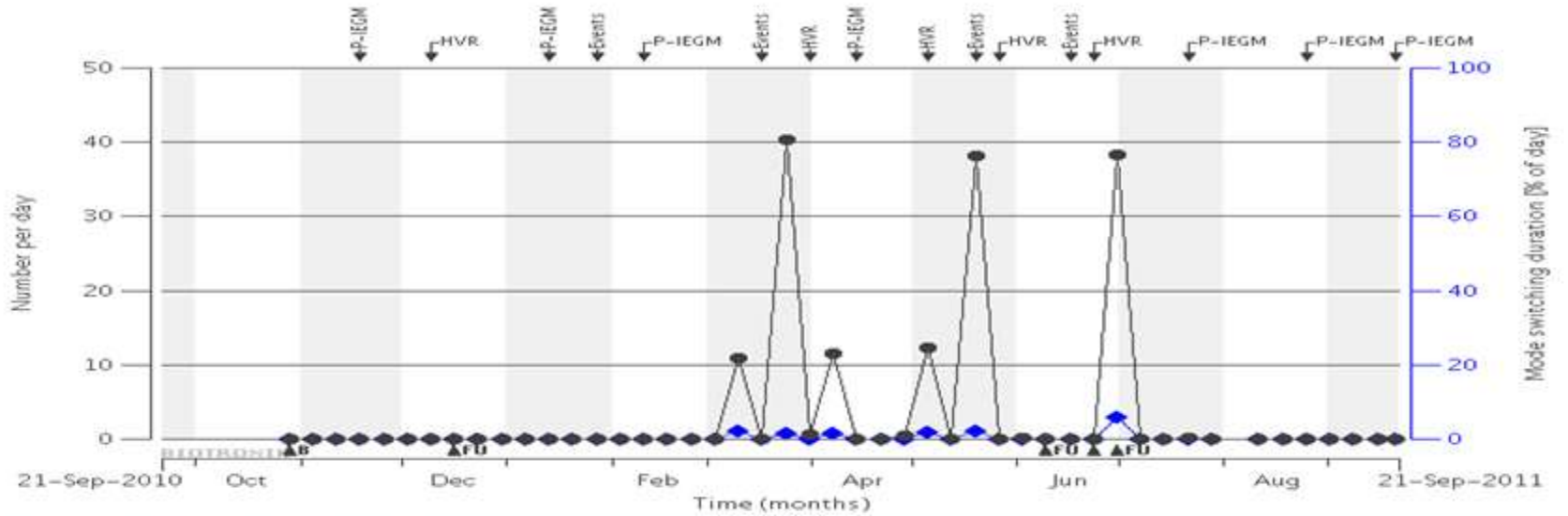


**Mode switching**

**Mode switching**

Figure shows mean values per week

● Number of mode switching per day ◆ Duration of mode switching [% of day]

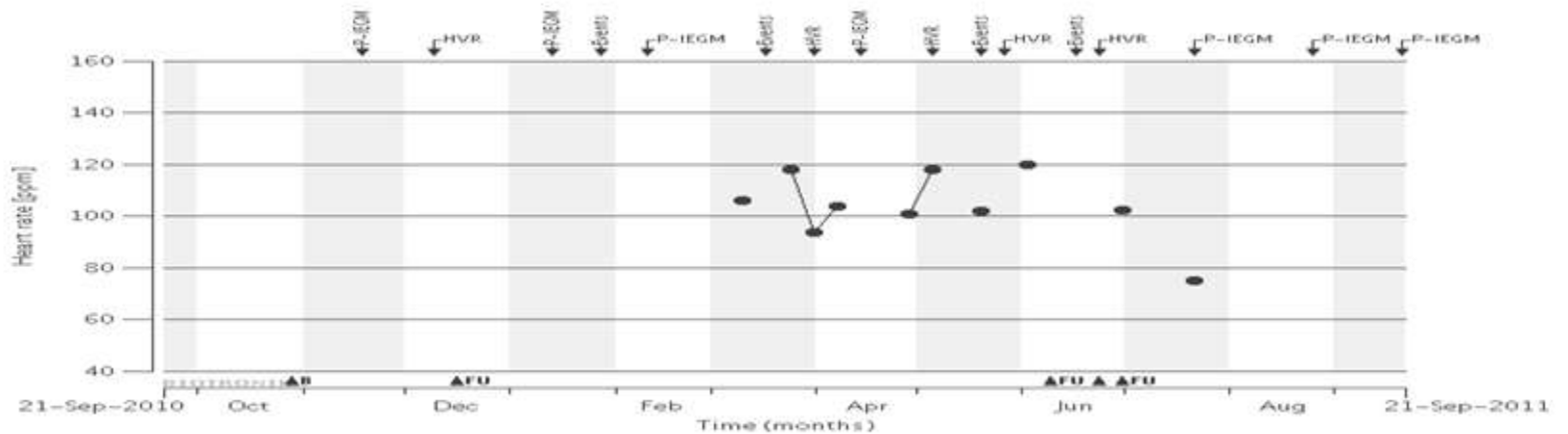


**Mean ventricular rate during mode switching**

**Mean ventricular rate during mode switching**

Figure shows mean values per week

● Mean ventricular rate during mode switching [ppm]



# Case 3 Outcome

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- Anticoagulation
- Beta-blockade for rate control

# Case 4

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- 63 yo man
- No significant past medical history
- Presented with trifasicular block
- Heart rate in 30s with symptoms
- At pacemaker implant: difficult achieving local pacing thresholds.
- Septal position, 2.6V at 0.5ms

# Case 4

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- Rapidly rising threshold and intermittent loss of capture.
- Rash appears on shins
- Hyper-eosinophilia myocarditis diagnosed.
- Pacing threshold stabilised with steroid therapy.

# Case 4 - issues

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- Pacemaker dependant
- How do we monitor pacing thresholds, other measured data?
- Patient anxiety?
- Driving restrictions.

# Case 5

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- 51 yo, c/o exertional dyspnoea (NYHA II-III) at routine cardiology clinic review 2011.
- PMH:
  - Cardiac arrest 2000.
  - LV dysfunction on ECHO, Mobitz II heart block.
  - Coronary bypass operation 2000 + DR ICD implanted 2009.
- Diagnosis: Heart failure

Monitoring

Patients for review

All patients

New patient

Administration

Users

New user

Patient groups

New patient group

Transmitters

Option templates

Clinic settings

Site tools

- Home
- What's new
- User profile
- Contact
- Imprint
- Help
- Sign out

[Back to overview](#) Patient 11 / 13 (filtered)

**Status on 28-Sep-2011 02:06** Lumax 340 DR-T / SN: 60413127

[Status](#)
[Device settings](#)
[Recordings](#)
[History](#)
[Patient profile](#)
[Options](#)
 Save/print (PDF)

[Summary](#)
[Device](#)
[Lead](#)
[Bradycardia/CRT](#)
[Atr. arrhythmia](#)
[Ven. arrhythmia](#)
[Physiologic. param.](#)
[HF monitor](#)

**Automatic remark** No anomalies detected.

**Status comment**

[Add comment](#)

**Quick View**

Name: - Lumax 340 DR-T (SN 60413127) Last message: 28-Sep-2011  
 Phone: - ICD Last clinic follow-up: 29-Jul-2011

Device status	
Status	OK
Battery status	MOL2 13% <span style="float: right;">EOS   ERI   MOL2   MOL1   BOL</span>
Battery voltage	2.94 V (28-Sep-2011)
Charge time	13.9 s for 40 J (19-Aug-2011 00:00:19)

Findings
No anomalies

Tachy settings						
	Zone limit	1st ATP	2nd ATP	1st shock	2nd shock	3rd - nth sho.
<b>VT1</b>	OFF	---	---	---	---	---
<b>VT2</b>	OFF	---	---	---	---	---
<b>VF</b>	300 ms	OFF		40 J	40 J	6 * 40 J

Brady / AF settings	
Mode	DDDR
Basic rate / UTR [ppm]	60 / 130
AV delay at 60 ppm / 130 ppm	180 / 140 ms
Mode switching	160 ppm / DDI

Historical status

- Previous status
- Next status
- Timeline
- Current status

# Patient history [REDACTED]

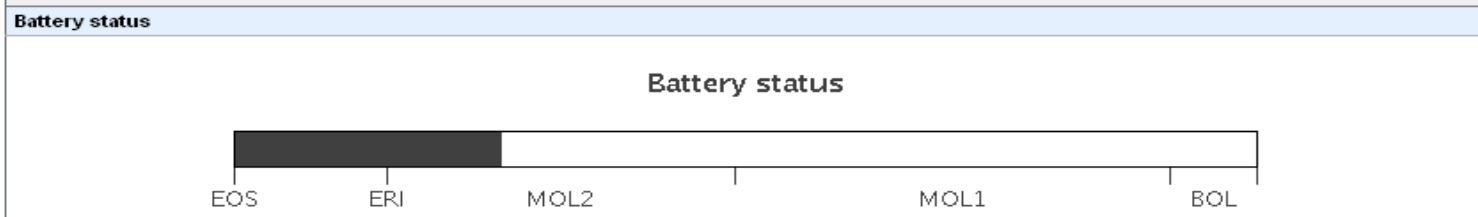
**Status on 27-Sep-2011 02:05** Lumax 340 DR-T / SN: 60413127

- Status**
  - Device settings
  - Recordings
  - History
  - Patient profile
  - Options
  - Save/print (PDF)
- 
- Summary
  - Device
  - Lead
  - Bradycardia/CRT
  - Atr. arrhythmia
  - Ven. arrhythmia
  - Physiologic. param.
  - HF monitor

Last device message created on 27-Sep-2011 00:55:36

Battery	
Status	MOL2 13%
Voltage [V]	2.93
Date of last battery voltage measurement	27-Sep-2011
Device	
Device status	OK
Device model	Lumax 340 DR-T
Date of implantation	(not for Lumax 300/340)
Last entry of shock list	
Time	19-Aug-2011 00:00:19
Charge time [s]	13.9
Energy [J]	40
Impedance [ohm]	---
Remark	Automatic formation
Home Monitoring	
Message type	time triggered
Device message created on	27-Sep-2011 00:55:36
End of last monitoring interval	27-Sep-2011 00:55:36
Transmitter	
Transmitter SN	48107064
Last transmission received on	27-Sep-2011 02:03:52

Time scale



Historical status

- Previous status
- Next status
- Timeline
- Current status

Patient history

Status on 27-Sep-2011 02:05 Lumax 340 DR-T / SN: 60413127

Status 
  Device settings 
  Recordings 
  History 
  Patient profile 
  Options 
  Save print (PDF)

Summary 
  Device 
  Lead 
  Bradycardia/CRT 
  Atr. arrhythmia 
  Ven. arrhythmia 
  Physiologic. param. 
  HF monitor

Last device message created on 27-Sep-2011 00:55:36

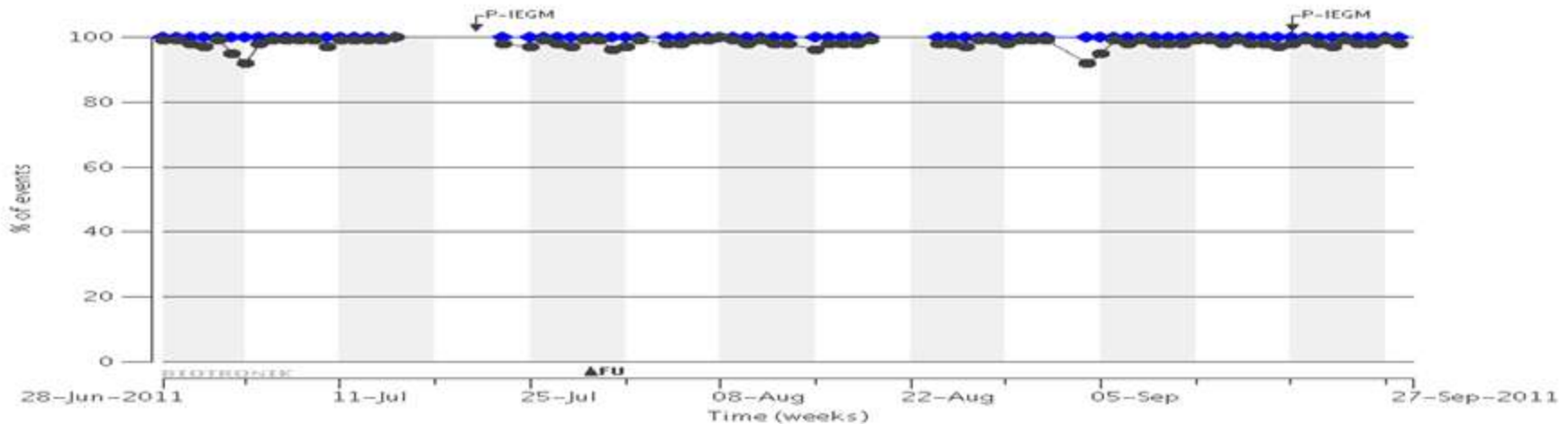
Paced rhythm		24 h	Since 30-Jul-2011 00:55:37 Mean values
Atrial pacing (Ap) [%]		98	98
Ven. pacing (Vp) [%]		100	100
<b>AV sequences (except during mode switching)</b>			
Intrinsic rhythm (As - Vs) [%]		0	0
VAT stimulation (As - Vp) [%]		1	2
Conducted atrial pacing (Ap - Vs) [%]		0	0
Dual-chamber pacing (Ap - Vp) [%]		99	98
VV sequence (Vx - Vx) [%]		0	0

Time scale

Paced rhythm

Paced rhythm

● Atrial pacing (Ap) [%] ◆ Ven. pacing (Vp) [%]



# Case 6 - Outcome

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- Pacing induced dyssynchrony
- For upgrade to CRT-D
- NYHA function class I.

# Case 6

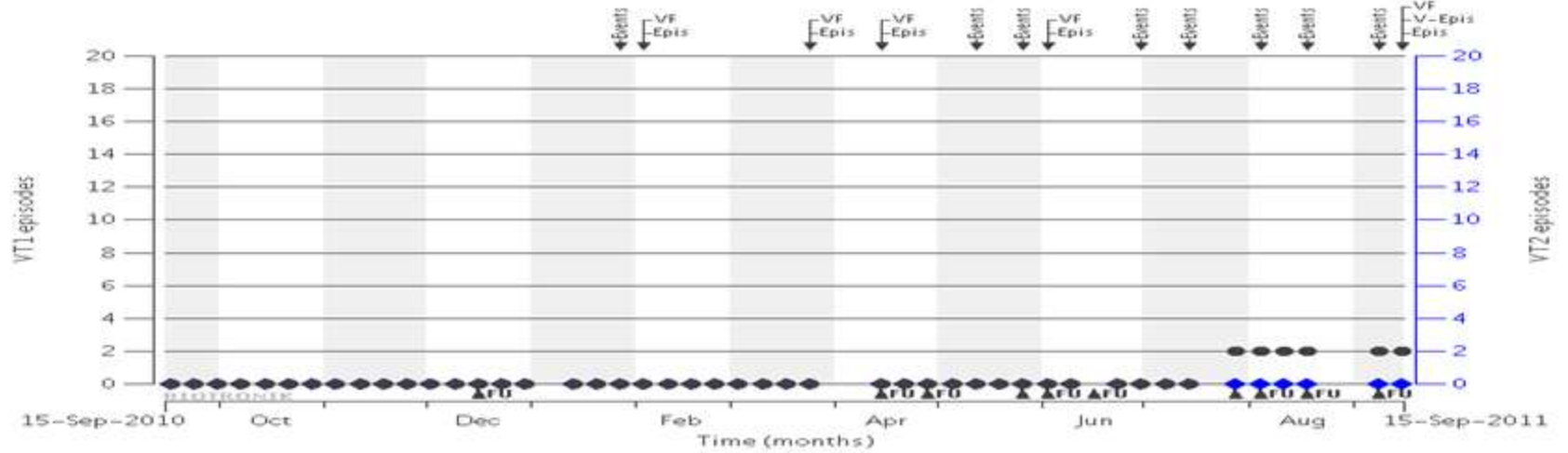
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- WG, 26 yr old construction site worker
- VF arrest Dec 2009: Idiopathic VF diagnosed.
- ICD implanted Dec 2009, Lumax 540 DR-T
- Infrequent VF events; triggered by single monomorphic ventricular ectopic beats.
- Single shock rescue.
- Beta-blockers and verapamil.

Time scale 1 year

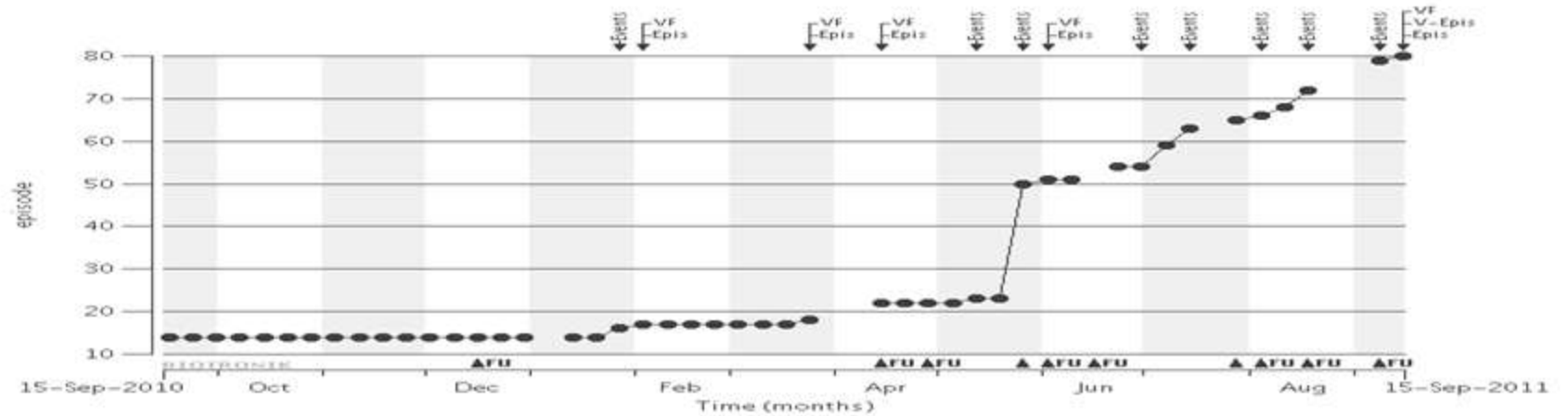
VT1/VT2 episodes

VT1/VT2 episodes  
Figure shows values at the end of the weeks  
● VT1 episodes ◆ VT2 episodes



VF episodes

VF episodes  
Figure shows values at the end of the weeks  
● VF episodes



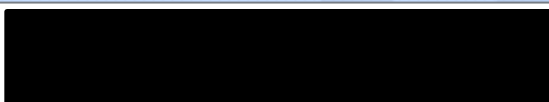
# Case 5

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- Radiofrequency ablation of ventricular ectopic focus.
- Flecainide started following more VF events.
- Discharged following 2 weeks without arrhythmia.
- Alert via email 5 days after discharge, 2 successive shocks.

**Historical status**

- Previous status
- Next status
- Timeline
- Current status



**Status on 16-Sep-2011 08:57** **Lumax 540 DR-T / SN: 60422703**  
Implantation: 17-May-2010

Status
Device settings
Recordings
History
Patient profile
Options
 Save/print (PDF)

Summary
Device
Lead
Bradycardia/CRT
Atr. arrhythmia
Ven. arrhythmia
Physiologic. param.
HF monitor

**Ven. arrhythmia** **VF detected** Acknowledged  
16-Sep-2011  
08:56.

1 VF detected between 15-Sep-2011 00:55:36 and 15-Sep-2011 10:08:44

**Recordings / Episode** **Ven. episode with 2 or more started shocks** Acknowledged  
16-Sep-2011  
08:56.

VF episode was detected on 15-Sep-2011 10:08:17 - It contained 1 delivered and 1 aborted shocks

**Episode details received** Acknowledged  
16-Sep-2011  
08:57. Postponed  
until 06-Oct-2011  
13:40.

Episode details were received for a spontaneous VF episode, which was detected on 15-Sep-2011 10:08:17

**Automatic remark** none

**Quick View**

Name: Mr Wojciech Gregorzcyk Lumax 540 DR-T (SN 60422703) Last message: 15-Sep-2011

Phone: - ICD implanted 17-May-2010 Last clinic follow-up: 08-Sep-2011

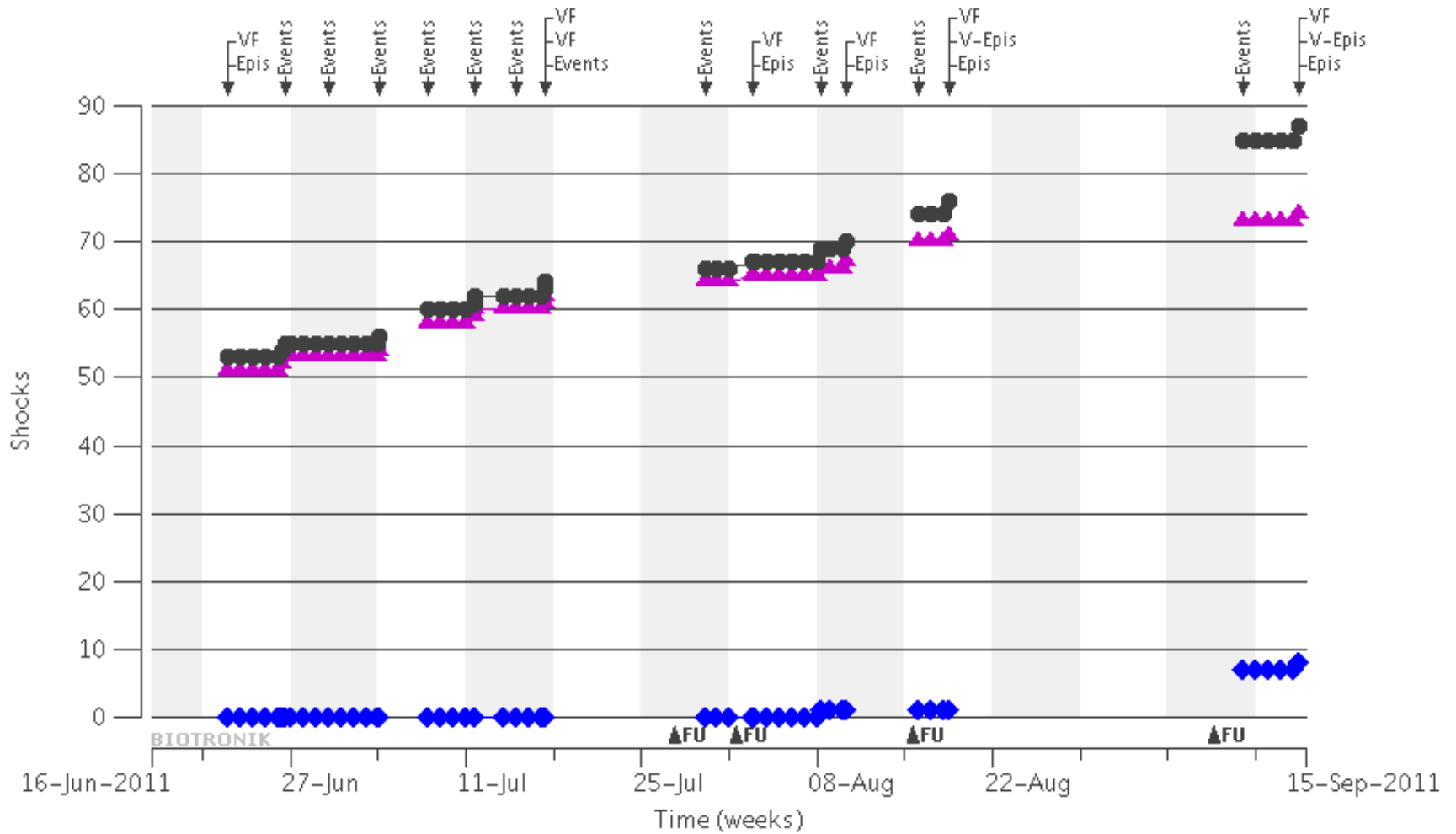
Device status	
Status	OK
Battery status	MOL2 13% <span style="float: right;">EOS ERI MOL2 MOL1 BOL</span>
Battery voltage	2.91 V (15-Sep-2011)
Charge time	3.9 s for 40 J (15-Sep-2011 10:08:33)

Findings
VF detected
Ven. epis. with 2 or more started shocks
Episode details received

Ven. shocks

Ven. shocks

● Shocks started ◆ Shocks aborted ▲ Shocks successful



# Case 6

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- Patient contacted and admitted to CCU.
- VF arrest: rescue external defibrillation successful.
- Intra-cardiac EGMs: under-sensing in VF by ICD.

# Case 6 - Outcomes

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- Real time event triggered alerts.
- Faster response to adverse events.
- ***Life saving***

# When is home monitoring useful?

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## For the Patient:

- Assurance
- Convenience: freedom from routine clinic visits
- Younger patients
- Busy lifestyles
- Elderly, debility (not patient activated).



# When is home monitoring useful?

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## For the Physiologist:

- Efficient use of pacemaker clinic time.
- Better surveillance of device related issues, and clinical events.

## For the Clinician:

- Secure, ready access to patient data.
- Real time alerts.
- Event and pacing monitoring facilitates clinical decision making.
- Improved patient care.
- ‘Mailbox’ overload, avoided by Biotronik Traffic Light System alerts’.

# Patient selection for Home Monitoring

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- Patient choice
- Good communication links with patient and primary care or referring physician.
- Accelerated follow-up: safety alerts, depletion.
- Arrhythmia monitoring and management.

# Patient selection for Home Monitoring

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Less benefit when:

- *Stable device function.*
- *No programming requirements.*
- *No arrhythmia.*
- *In person follow up required annually or for other review??*

# Why Remote Monitoring

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- Allows Individualised care
- Good communication links with patient and primary care or referring physician.
- Essential tool in the follow-up of ICED patients
  - Safety
  - Patient satisfaction
  - Clinical efficiency

# Why NOT Remote Monitoring

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- Allows Individualised care
- Good communication links with patient and primary care or referring physician.
- Essential tool in the follow-up of ICED patients
  - Safety
  - Patient satisfaction
  - Clinical efficiency

